

What is claimed is:

1. An image-capturing element, comprising:
  - a plurality of pixels provided in a matrix, each having a photoelectric conversion element;
  - 5 a plurality of color filters, each provided at one of said plurality of pixels; and
  - a read out circuit that adds together electrical charges of pixels within every specific range among said plurality of pixels and enables a sequential read out of 10 added electrical charges.
2. An image-capturing element, comprising:
  - a plurality of pixels provided in a matrix, each having a photoelectric conversion element, wherein:
    - 15 a green color filter is provided at each of  $2 \times c$  pixels, a blue color filter is provided at each of  $1 \times c$  pixels and a red color filter is provided at each of remaining  $1 \times c$  pixels within a range of  $4 \times c$  pixels adjacent to each other vertically and horizontally among 20 said plurality of pixels, the  $c$  representing a natural number; and
    - 25 a read out circuit is further provided that adds electrical charges of the  $4 \times c$  pixels adjacent to each other vertically and horizontally and enables a sequential read out of added electrical charges.

3. An image-capturing element according to claim 2,  
wherein:

the green color filter, the blue color filter and the  
5 red color filter each achieve predefined spectral  
characteristics to enable said read out circuit to read out  
a brightness signal by adding together electrical charges of  
the  $4 \times c$  pixels adjacent to each other vertically and  
horizontally.

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4. An image-capturing device comprising:  
an image-capturing element having a plurality of pixels  
provided in a matrix each of which has a photoelectric  
conversion element, a green color filter being provided at  
15 each of  $2 \times c$  pixels within a range of  $4 \times c$  pixels adjacent  
to each other vertically and horizontally among said  
plurality of pixels, a blue color filter being provided at  
each of  $1 \times c$  pixels within the range, a red color filter  
being provided at remaining  $1 \times c$  pixels within the range,  
20 and a read out circuit that adds electrical charges at the  $4$   
 $\times c$  pixels adjacent to each other vertically and  
horizontally and enables a sequential read out of added  
electrical charges, the  $c$  representing a natural number; and  
a drive circuit that provides said read out circuit  
25 with a drive signal to enable said read out circuit to add

electrical charges of the  $4 \times c$  pixels adjacent to each other vertically and horizontally and enables a sequential read out of added electrical charges.

5 5. An image-capturing device according to claim 4, wherein:

      said image-capturing element has ( $d \times m$  in a horizontal direction)  $\times$  ( $e \times n$  in a vertical direction) pixels, the  $m$ ,  $n$ ,  $d$  and  $e$  representing natural numbers; and

10       said read out circuit, in response to the drive signal provided by said drive circuit, adds together electrical charges of  $d \times e$  pixels adjacent to each other and enables a read out of ( $m$  in a horizontal direction)  $\times$  ( $n$  in a vertical direction) pixel signals.

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6. An image-capturing device according to claim 5, further comprising:

      a selection unit that selects a mode for reading out the ( $m$  in a horizontal direction)  $\times$  ( $n$  in a vertical direction) pixel signals or a mode for reading out the ( $d \times m$  in a horizontal direction)  $\times$  ( $e \times n$  in a vertical direction) pixel signals without adding.

20 7. An image-capturing device according to claim 4, wherein:

the green color filter, the blue color filter and the red color filter each achieve predefined spectral characteristics; and

5       said read out circuit adds together electrical charges of the  $4 \times c$  pixels adjacent to each other vertically and horizontally to read out a brightness signal.

8.       An image-capturing element, comprising:

10      a plurality of pixels provided in a matrix, each having a photoelectric conversion element, wherein:

color filters of a single color are provided at each group of a specific number of pixels lying adjacent to each other among said plurality of pixels; and

15      a read out circuit is provided that adds together electrical charges of the specific number of pixels lying adjacent to each other and sequentially reads out added electrical charges.

9.       An image-capturing device, comprising:

20      an image-capturing element having a plurality of pixels provided in a matrix each of which has a photoelectric conversion element, color filters of a single color being provided at each group of a specific number of pixels lying adjacent to each other among said plurality of pixels, and a 25      read out circuit that adds together electrical charges of

the specific number of pixels lying adjacent to each other and enables a sequential read out of added electrical charges; and

5 a drive circuit that provides said read out circuit with a drive signal to enable said read out circuit to add together electrical charges of the specific number of pixels lying adjacent to each other and enables a sequential read out of added electrical charges.

10 10. An image-capturing device according to claim 9, wherein:

said image-capturing element has  $(d \times m$  in a horizontal direction)  $\times (e \times n$  in a vertical direction) pixels, the  $m$ ,  $n$ ,  $d$  and  $e$  representing natural numbers; and

15 said read out circuit, in response to the drive signal provided by said drive circuit, adds together electrical charges of  $d \times e$  pixels adjacent to each other for a read out and enables a read out of  $(m$  in a horizontal direction)  $\times (n$  in a vertical direction) pixel signals.

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11. An image-capturing device according to claim 9, further comprising:

a selection unit that selects a mode for reading out the  $(m$  in a horizontal direction)  $\times (n$  in a vertical direction) pixel signals or a mode for reading out the  $(d \times$

m in a horizontal direction) x (e x n in a vertical direction) pixel signals without adding.

12. An image-capturing element comprising:

5 a plurality of pixels provided in a matrix, each having a photoelectric conversion element; and

a plurality of color filters, each provided at one of said plurality of pixels, wherein:

10 among said plurality of color filters, color filters of a single color are provided for pixels within each specific range and the color filters within the specific range have different transmissivities.

13. An image-capturing element according to claim 12,  
15 wherein:

the color filters of the single color having different transmissivities from each other are provided adjacent to each other.

20 14. An image-capturing element according to claim 12,  
wherein:

pixels at which the color filters of the single color have different transmissivities have identical spectral characteristics.

15. An image-capturing device, comprising:  
an image-capturing element having a plurality of pixels  
provided in a matrix each of which has a photoelectric  
conversion element, and a plurality of color filters being  
5 provided at the plurality of pixels respectively, the color  
filters being of a single color within each specific range,  
the color filters within said specific range having  
different transmissivities, the image-capturing element  
further having a read out circuit that adds together  
10 electrical charges of the pixels within said specific range  
and enables a sequential read out of added electrical  
charges; and  
a drive circuit that provides said read out circuit  
with a drive signal to enable said read out circuit to add  
15 together electrical charges of the pixels within said  
specific range and enables a sequential read out of added  
electrical charges.

16. An image-capturing device according to claim 15,  
20 wherein:  
said color filters of the single color having different  
transmissivities are provided adjacent to each other; and  
said read out circuit adds together electrical charges  
corresponding to color filters of the single color having

different transmissivities and reads out added electrical charges.

17. An image-capturing device comprising:

5       an image-capturing element having a plurality of pixels provided in a matrix each of which has a photoelectric conversion element, and a plurality of color filters being provided at the plurality of pixels respectively, the color filters being of a single color within each specific range,

10      the color filters within said specific range having different transmissivities, the image-capturing element further having a read out circuit that enables a sequential read out of electrical charges of the pixels; and

15      a drive circuit that provides said read out circuit with a drive signal to sequentially read out the electrical charges of the pixels within said specific range independently of each other.

18. An image-capturing device comprising:

20      an image-capturing element having a plurality of pixels provided in a matrix pattern each of which has a photoelectric conversion element, a plurality of color filters being provided at said plurality of pixels respectively, and a read out circuit that enables a

sequential read out of electrical charge signals of said pixels;

a drive circuit that provides said read out circuit with a drive signal to enable said read out circuit to add

5 electrical charge signals obtained from pixels with color filters thereof lying adjacent to each other, being of a single color and having the same transmissivity and then to enable a read out of added electrical charge signals, and also to enable said read out circuit to independently read

10 out electrical charge signals obtained from the pixels with color filters thereof lying adjacent to each other, being of a single color and achieving different transmissivities without adding the electrical charge signals together; and

a signal processing device that converts signals

15 obtained from adjacent single color pixels with different transmissivities to one brightness signal by synthesizing the signals while ensuring that the signals continuously change in correspondence to an incident light quantity.

20 19. An image-capturing device according to claim 18, further comprising:

a selection unit that selects a first mode or a second mode, wherein:

when said first mode is selected, said drive circuit

25 provides said read out circuit with a drive signal to enable

10 said read out circuit to add electrical charge signals obtained from pixels with color filters thereof lying adjacent to each other being of a single color and having the same transmissivity and then to read out added 5 electrical charge signals and also to enable said read out circuit to enable reading out electrical charge signals obtained from pixels with color filters thereof lying adjacent to each other being of a single color and having different transmissivities independently of each other 10 without performing addition;

15 when said second mode is selected, said drive circuit provides said read out circuit with a drive signal to enable said read out circuit to generate a first added signal by adding together the electrical charge signals obtained from the pixels with the color filters thereof lying adjacent to each other being of a single color and having the same transmissivity, to enable said read out circuit to generate a second added signal by adding together the electrical charge signals obtained from the pixels with the color 20 filters thereof lying adjacent to each other being of a single color and having different transmissivities, and also to enable said read out circuit to add said first added signal and said second added signal and enable a read out of an addition signal of said first added signal and said 25 second added signal; and

when said second mode is selected, said signal processing device stops synthesizing processing.

20. An image-capturing circuit for processing a signal  
5 provided by a solid image-capturing element, the solid image-capturing element having a pixel matrix which includes a plurality of pixels provided in a matrix, each pixel having a photoelectric conversion element, the solid image-capturing element reading out electrical charge signals from  
10 the pixel matrix by vertically transferring and horizontally transferring the electrical charges and adding together electrical charges of a plurality of pixels lying adjacent to each other in a horizontal direction in a horizontal transfer output, comprising:  
15 a clamp circuit that clamps a feed through level of an output signal from the solid image-capturing element at a constant potential; and  
a plurality of sample hold circuits that sample and hold an output signal from said clamp circuit over a  
20 plurality of different periods.

21. An image-capturing device comprising:  
an image-capturing optical system;  
a solid image-capturing element having a pixel matrix  
25 with a plurality of pixels provided in a matrix, each pixel

having a photoelectric conversion element, said plurality of pixels receiving an image light of a subject via said image-capturing optical system, said solid image-capturing element reading out electrical charge signals from said pixel matrix by vertically transferring and horizontally transferring the electrical charge signals and adding together electrical charge signals of a plurality of pixels adjacent to each other in the horizontal direction in a horizontal transfer output;

10 a clamp circuit that clamps a feed through level of an  
output signal from said solid image-capturing element at a  
constant potential;

15 a plurality of sample hold circuits that sample and hold an output signal from said clamp circuit over a plurality of different periods; and

a drive circuit that provides said clamp circuit and said sample hold circuits with a drive signal.

22. An image-capturing device according to claim 21,  
20 wherein:

said pixel matrix has color filters of a single color for every four pixels adjacent to each other vertically and horizontally;

25 said solid image-capturing element sequentially outputs an electrical charge signal at one of two pixels adjacent to

each other in the horizontal direction and an added electrical charge signal achieved by adding together electrical charge signals of the two pixels adjacent to each other in the horizontal direction; and

5       said plurality of sample hold circuits include two sample hold circuits, one for sampling and holding the electrical charge signal of one of the two pixels and another for sampling and holding the added electrical charge signal achieved by adding together the electrical charge

10      signals of the two pixels.

23. An image-capturing device according to claim 21, further comprising:

      a switching circuit for selectively inputting an output

15      of said clamp circuit to said plurality of sample hold circuits.

24. An image-capturing device according to claim 21, wherein:

20       said plurality of sample hold circuits are commonly connected to an output of said clamp circuit, sample an output of said clamp circuit during different time periods from each other and output in parallel a signal achieved by adding together electrical charge signals at a plurality of

pixels of a single color adjacent to each other in the horizontal direction and a signal achieved without addition.

*B* 25. An image-capturing device according to claim 21, further comprising:

a selection unit that selects a mode for outputting a electrical charge signal at one of two pixels adjacent to each other in the horizontal direction or a mode for outputting an added signal electrical charge achieved by 10 adding together signal electrical charges at the two pixels adjacent to each other in the horizontal direction.

26. A driving method for an image-capturing element that has  $2 \times a \times m$  pixels along a horizontal direction and  $2 \times b \times n$  pixels along a vertical direction arranged in a matrix, 15 each pixel having a photoelectric conversion element, the image capturing element having a color filter array in which color filters of a single color are arranged at every first pixel group that has  $2 \times a$  pixels along a horizontal direction and  $2 \times b$  pixels along a vertical direction adjacent to each other, a color arrangement of the color filters at every first pixel group achieving a Bayer array, the a, b, m and n each representing a natural number, the driving method comprising:

a step in which either a color image mode or a monochrome image mode is selected;

a step in which driving of the image-capturing element is implemented to add together individual pixels in the

5 first pixel group for readout when the color image mode is selected; and

a step in which driving of the image-capturing element is implemented to add together individual pixels in an

10 second pixel group achieved by shifting by "a" pixels in the horizontal direction and by "b" pixels in the vertical direction relative to a position of the first pixel group for readout when the monochrome image mode is selected.

27. A driving method for an image-capturing element that

15 has a plurality of pixels arranged in a matrix, each pixel having a photoelectric conversion element, the image capturing element having a color filter array in which color filters of a single color are arranged at every four pixels adjacent to each other in vertical and horizontal

20 directions, a color arrangement of the color filters at every said four pixels achieving a Bayer array, the driving method comprising:

a step in which either a color image mode or a monochrome image mode is selected;

a step in which driving of the image-capturing element is implemented to add together said four pixels for readout when the color image mode is selected; and

5 a step in which driving of the image-capturing element is implemented to add together other four pixels achieved by shifting by one pixel in the horizontal direction and by one pixel in the vertical direction relative to a position of said four pixels for readout when the monochrome image mode is selected.

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28. A image-capturing device comprising:

an image-capturing element that has  $2 \times a \times m$  pixels along a horizontal direction and  $2 \times b \times n$  pixels along a vertical direction arranged in a matrix, each pixel having a 15 photoelectric conversion element, the image capturing element having a color filter array in which color filters of a single color are arranged at every first pixel group that has  $2 \times a$  pixels along a horizontal direction and  $2 \times b$  pixels along a vertical direction adjacent to each other, a color arrangement of the color filters at every first pixel 20 group achieving a Bayer array, the  $a$ ,  $b$ ,  $m$  and  $n$  each representing a natural number;

a switching device that selects either a color image mode or a monochrome image mode; and

a drive control device that implements drive control of the image-capturing element to add together individual pixels in the first pixel group for readout when the color image mode is selected, and implements drive control of the 5 image-capturing element to add together individual pixels in an second pixel group achieved by shifting by "a" pixels in the horizontal direction and by "b" pixels in the vertical direction relative to a position of the first pixel group for readout when the monochrome image mode is selected.

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29. A image-capturing device comprising:
  - an image-capturing element that has a plurality of pixels arranged in a matrix, each pixel having a photoelectric conversion element, the image capturing element having a color filter array in which color filters of a single color are arranged at every four pixels adjacent to each other in vertical and horizontal directions, a color arrangement of the color filters at every said four pixels achieving a Bayer array;
  - 15 a switching device that selects either a color image mode or a monochrome image mode; and
  - 20 a drive control device that implements drive control of the image-capturing element to add together said four pixels for readout when the color image mode is selected.
  - 25 implements drive control of the image-capturing element to

add together other four pixels achieved by shifting by one pixel in the horizontal direction and by one pixel in the vertical direction relative to a position of said four pixels for readout when the monochrome image mode is  
5 selected.

30. An image-capturing device according to claim 28, further comprising:

10 a color image generating device that generates color image information by using an output signal from said image-capturing element when the color image mode is selected; and  
a monochrome image generating device that generates monochrome image information by using an output signal from  
15 said image-capturing element when the monochrome image mode is selected.